

# C A M P E P

Commission on Accreditation of Medical Physics Education Programs, Inc.

---

*Confidential*

## Program Evaluation

**Graduate Program:**      **Master of Science in Nuclear Engineering with  
a focus in Medical Physics**  
**University of Missouri**  
**Nuclear Science and Engineering Institute**

**Reviewers:**              **Edward F. Jackson, Ph.D.**  
**Reinhard Gahbauer, M.D.**

**Site Visit Date:**        **25-26 April 2011**  
**Evan Boote, Ph.D.,**

**Report Submitted to:** **Tushar K. Ghosh, Ph.D.,**  
**Sudarshan K. Loyalka, Ph.D.**  
**Co-Directors**

**cc: Edward Jackson, Ph.D. Chair, CAMPEP GEPRC**

### Notes:

This report makes reference to the self study document submitted as part of this review process and which contains full details of the program.

1. **Observations** are general comments related to performance of the program within the context of the appropriate CAMPEP standards.
2. **Requirements** are conditions that must be met by the program as part of the accreditation process.
3. **Recommendations** are suggestions by the program reviewers that are offered as improvements in the program but that are not requirements for accreditation.

# C A M P E P

Commission on Accreditation of Medical Physics Education Programs, Inc.

---

***Confidential***

## General Comments

While over 100 MS & PhD students have graduated from this program during its greater than 30 year history, the masters degree program reviewed was recently revised in preparation for CAMPEP accreditation review. The course work offered is, in general, consistent with AAPM Report 197 and the current format includes didactic lecture, laboratory, internship, and research components. Key strengths of the program include a diverse and committed faculty and a high level of support from the administration at MU Graduate School and MU School of Medicine, as well as from the chair of the Department of Radiation Oncology at Washington University St. Louis.

## Compliance Summary

		Compliance			
		Substantial	Partial	Minimal	N/A
I	Program Goal and Objectives	<b>X</b>			
II	Program Evolution and History				<b>X</b>
III	Program Structure and Governance		<b>X</b>		
IV	Curriculum		<b>X</b>		
V	Students	<b>X</b>			
VI	Resources	<b>X</b>			

# C A M P E P

Commission on Accreditation of Medical Physics Education Programs, Inc.

---

**Confidential**

## Program Evaluation

### I. Program Goals and Objectives

### Substantial Compliance

*The objective of a program must be clearly formulated. It is essential that the program prepare its students (1) for further education, teaching, and research in medical physics, and (2) to assume appropriate responsibilities in the clinical practice of medical physics under the supervision of a certified medical physicist or to enter a medical physics residency program in at least one subspecialty (radiation oncology, diagnostic radiology, or nuclear medicine).*

**Observations:** The goals and objectives of the program are clearly stated in the submitted self study and are consistent with CAMPEP requirements. From the self study: "The main goal of the *Master of Science in Nuclear Engineering with a focus in Medical Physics* degree program is to meet the demands of hospitals, clinics, and industry for well-trained medical physicists... It is designed to provide a high level of education and professional training to matriculating students so that they are well prepared following graduation for entry into an accredited medical physics residency program or for continuing doctoral education and research." It is curious as to why only the MS focus program is put forward for accreditation review as the PhD program would qualify for accreditation, if consistent with the academic requirements of the MS program and with the added depth of research, mentorship, and funding resources clearly already present.

**Requirements:** None

**Recommendations:** None

### II. Program Evolution and History

*A brief history of the program's evolution including faculty, staff and students shall be presented. An institution preparing a self-study in maintenance of its accreditation shall list in this section all significant changes in the program since the previous self-study. These changes shall be described in more detail in the appropriate section of the self-study.*

**Observations:** This program originated in 1976 in the Nuclear Science and Engineering Institute (NSEI) with the offering of a course on clinical dosimetry. The first official degree granted by NSEI with medical physics as a focus area was awarded in 1981. The program was restructured, and the curriculum expanded, in 2000 and an additional curriculum modification was made in 2004-2005 when several new imaging science courses were introduced. Since this time, the program has grown substantially in terms of the number of students and faculty. In recent years, faculty from Washington University in St. Louis (WUSL) have become increasingly involved in the program and currently support student internships and thesis research and, in addition, teach parts of the core curriculum. The current program is offered by the University of Missouri (MU) NSEI in collaboration with the

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

MU School of Medicine, the MU School of Health Professions, and the Department of Radiation Oncology at WUSL. Support for student internships and research is also provided by faculty at the Harry S. Truman Memorial VA Hospital, which is a particularly valuable resource for imaging science, molecular imaging, and small animal imaging applications. The MS in Nuclear Engineering with a focus in Medical Physics degree is awarded by the MU Graduate School.

### **III. Program Structure and Governance**

### **Compliance**

*The self-study shall delineate relationships between departments and other academic programs that provide students with the necessary knowledge and broad understanding of the fundamentals of medical physics. The relationship to clinically oriented programs, such as residency training programs for medical physicists or physicians shall be described. The position of the medical physics program within an institution shall be clearly defined. Any collaborative arrangements among departments shall be specified. If several departments participate in the program, the role and commitment of each shall be explained. Likewise, access to clinical facilities and equipment shall be described. The position of the program director in the academic and clinical organization shall be explained, together with the relationship of the key director to other participating individuals, groups, and organizations. The process by which the program director is chosen shall be noted. The mechanism by which the faculty is approved by the program shall be described, together with the means by which the direction and content of the program is governed by the faculty. Faculty committees shall be listed and their purpose defined. The process by which the various committees are established and committee members chosen shall be described. Minutes of all committee and faculty meetings shall be maintained and available for GEPRC review at initial accreditation and reaccreditation site visits.*

**Observations:** The Medical Physics Program is administered by the NSEI, and the degree is awarded by the Graduate School (as the NSEI is an institute within the Graduate School). There are currently three co-directors of the program: Dr. Tushar Ghosh (NSEI), Dr. Sudarshan Loyalka (NSEI), and Dr. Evan Boote (MU Department of Radiology). A *Medical Physics Program Committee* was recently formed to serve as the primary governance body for the Program. The membership of this committee is defined in the self-study as consisting of: 1) the NSEI Director, 2) the three co-directors of the Program, and 3) "two board-certified medical physicists drawn from the pool of all NSEI Medical Physics faculty, one from Therapy and one from Imaging". At the time of the site visit, however, the two board-certified medical physicists were indicated to be Eric Klein and Susan Richardson, both faculty at WUSL. In the self study, this is one of a few key modifications to the Program that was made in preparation for the accreditation review by CAMPEP. The creation of this top-level governance committee is considered by the reviewers to be a positive, but it was clear at the time of the site visit that the formalization of this committee was recent and some details were still evolving.

The three co-director leadership structure is unusual amongst all currently accredited programs. While the reported roles of each co-director were defined in the self-study, the lack of an identified Program Director was the cause for some concern. The principal concern is that the students might not clearly understand to whom a given specific problem or concern should be addressed and, furthermore, that consistent advice and direction

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

might be an issue if students with similar problems go to differing co-directors.

Finally, it was noted during the site visit that there may be a subset of faculty, i.e., the faculty heavily involved in the imaging research at the Harry S. Truman VA Memorial Hospital, who are not represented on the *Medical Physics Program Committee* even though they are very active in the lectures and internship and research training components of the Program. Assuring representation to the Program governance body from all key groups of Program faculty is important in all aspects of the Program, including curriculum development and review, admissions, strategic planning, etc.

*Requirements:* None

*Recommendations:*

1. The *Medical Physics Program Committee* membership should be inclusive of all key groups of faculty actively supporting the Program.
2. The roles of the three co-directors should be very clearly defined to the students in the Program to ensure consistency.

## **IV. Curriculum**

## **Compliance**

### **A. Degree Requirements**

*The requirements for graduation from the program shall be defined. This shall include didactic curriculum, method of clinical training and research training. In addition, any other requirements for graduation shall be stated.*

*Observations:* The MS degree program requires 34 credit hours of medical physics related didactic lecture courses and labs as well as a clinical internship and research experience. The research experience is gained by completion of either a MS thesis or a research project. (The research project provides 3 credits and the thesis provides 6 credits.)

*Requirements:* None

*Recommendations:* None

### **B. Design and Content**

*The curriculum shall be consistent with recommendations presented in AAPM Report Number 197 "Academic Program Recommendations for Graduate Degrees in Medical Physics." Additionally, the students shall also have an understanding of patient privacy issues, ethics, etc., and receive training in regulations appropriate to clinical activities and research consistent with the recommendations in AAPM Report 159, "Recommended ethics curriculum for medical physics graduate and residency programs". Curricula will be evaluated with regard to the intent to satisfy the scope of these recommendations as opposed to strict adherence to all recommendations made in these reports.*

*Observations:* The program requires classroom, laboratory, clinical internship, and research experiences. While the curriculum, in general, satisfies the guidelines established in AAPM Report 197, a limited number of required modifications/additions and a few recommendations were established during the preliminary review of the self study and confirmed during the site visit.

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

#### *Requirement:*

1. Education in the areas of professional ethics / scientific misconduct / conflict of interest must be provided. Documentation of the means by which this is addressed must be provided in the first annual report from the Program. (See also AAPM Report 159, *Recommended Ethics Curriculum for Medical Physics Graduate and Residency Programs*.)

#### *Recommendations:*

1. The “core curriculum” required of each and every MS degree student should be more clearly defined. It is difficult, from the current self study documentation and even in discussions with the program leadership, to determine if each student is *required* to complete all didactic courses that are considered essential to satisfy the core content defined in Report 197. The 34 hours of required coursework and research project / thesis defined in Table 2 of the self study do not, for example, include Anatomy, Radiation Safety, or Advanced Engineering Mathematics. The course in Radiation Protection, NE8471, is listed in Appendix C, but not discussed or noted as being required. It is noted that Anatomy will be required of all medical physics students beginning fall 2010 and this was confirmed at the time of the site visit. It was noted that other courses listed above, such as Radiation Safety and Advanced Engineering Mathematics, can be waived dependent on the student’s background. In such cases, the use of well-defined and consistent criteria in the evaluation of such prerequisite credits or waivers must be utilized and documented for each student.
2. The Advanced Engineering Mathematics course, while providing a commendable coverage of transforms, ordinary and partial differential equations, complex analysis, etc. important in medical physics, does not address statistical analysis topics described in Report 197. The key Topics of Primary Interest defined in this report, including models for statistical inference, experimental design for hypothesis testing, regression models, multivariate analysis, and categorical data analyses, should be addressed in the curriculum. Coverage of these topics does not necessarily need to be accomplished in a single course, but the Program should be able to provide a concise list of these topics and the course, or courses, in which the topics are addressed.
3. It was clear in the self study and during the site visit that the curriculum is still evolving, with new courses being added and others being modified. For example, one of the two required imaging courses (NE8435) is variably referred to as *Fundamentals of Imaging in Medicine* or *Radiation Oncology Imaging* in the report (and during the site visit). This should be clarified at the time of the first annual report from the Program.
4. The increased involvement and commitment of the WUSL faculty in the curriculum is commendable. As the travel time to or from WUSL is approximately 2 hours, however, distance learning options, e.g., video conferencing, have been implemented for some courses. The students indicated that the current model could be improved substantially. During the site visit, specific plans, funded by MU NSEI, for improved video conferencing were provided. The implementation of these plans should be confirmed in future annual reports from the Program.

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

#### **C. Sample Academic Plans**

*This section shall include sample academic plans that are distributed to incoming students, documenting an adequate frequency of courses. If some required courses are offered every other year, then academic plans for students entering on even or odd years shall be included. The provision for individual student needs and interests shall be discussed.*

**Observations:** The sample academic plans described in the self study are consistent with CAMPEP requirements, and the students expressed no major concerns regarding the quality of instruction.

**Requirements:** None

**Recommendations:** The frequency of offering of a limited number of the required courses is every other year. This may lead to scheduling difficulties and/or large class sizes if the Program enrollment grows beyond the current level. It is recommended that all required courses be offered each year, if possible.

#### **D. Curriculum Evaluation and Modification**

*The process by which the institution approves the curriculum and course content as well as changes in the curriculum and course content shall be described. A documented process shall be in place to keep the curriculum up-to-date with advances in technology relevant to the practice of medical physics. The methodology for the periodic review of the curriculum and the evaluation of courses by the students and faculty shall be described together with the frequency of evaluation and the mechanisms for change.*

**Observations:** The process for curriculum evaluation and modification are consistent with CAMPEP requirements. The students review the courses following each offering using standardized university evaluation forms. The evaluation results are provided to each instructor and to the appropriate department chairs. The faculty currently review curriculum modifications and consider new courses on an as needed basis.

**Requirements:** None

**Recommendations:**

1. A formal "top-down" curriculum review should be performed on a regular basis, perhaps every five years. Information from recent graduates, current students, the AAPM and other medical physics organizations, etc. should be considered. The option to have a student representative involved in this process, *e.g.*, a Student-Faculty Liaison, might be considered to provide maximal constructive criticism from current students.
2. Processes should be established to ensure there is appropriate input and review by all major stakeholders in / contributors to the Program, including the MU/VA faculty, MU School of Medicine faculty, and WSUL faculty. Attention to the membership of the *Medical Physics Program Committee* would, for example, address this concern.

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

## **V. Students**

## **Substantial Compliance**

### **A. Admissions**

*The application materials provided to prospective students shall be described. It is expected that these materials include a description of the institution's medical physics program, information on the admission standards including appropriate degrees, undergraduate coursework (and graduate coursework if appropriate), GPA, GRE scores, TOEFL scores, etc., and sufficient information on the application process for the student to make an application to the program.*

*Students entering a medical physics education program shall have a strong foundation in basic physics. This shall be documented by either a degree in physics or a degree in engineering or other area of physical science with physics education equivalent to a minor in physics (including at least three upper level undergraduate physics courses or equivalent required for a physics major). If applicants with deficiencies in their physics background are conditionally admitted to the program, the provision for remedial physics education shall be provided and described in the self-study.*

*The method of processing a student application shall be described, including the evaluation process and the method of informing students of action taken on their application. Application due dates and an admission process timeline shall be specified.*

*Admission policies shall be nondiscriminatory except as related to standards for academic qualifications. The self-study shall provide information about the students admitted to the program for the previous five years and shall include previous degrees, GPA, GRE scores and any other information that can be easily compared with admission guidelines.*

**Observations:** The Program strives to have a diverse interdisciplinary student body and research portfolio. This is considered by the reviewers to be a strength of the Program. However, it requires that the Program Director maintain careful documentation of the review of each admitted student's upper level undergraduate physics education to be able to confirm that the necessary courses were taken before enrolling in the Program or a plan for remediation of such courses while in the Program (and documentation of successful completion of the plan) is maintained. The need for this was clearly understood by all co-directors of the Program and the site visit team confirmed this information had, indeed, been made known to the current students enrolled in the Program.

**Requirements:** None

**Recommendations:** Documentation necessary to ensure compliance with the issues noted in "Observations", above, must be maintained and made available for review by CAMPEP if requested.

### **B. Recruitment Efforts**

*Each program shall have active recruitment efforts which could include contacts with nearby university physics departments or their Society for Physics Students and booths at local meetings of the American Physical Society or the Canadian Association of Physicists.*

**Observations:** The recruitment efforts of the Program are adequately defined in the self study and were discussed at the time of the site visit.

**Requirements:** None

**Recommendations:** None



# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

#### **C. Enrollment**

*The professional status and accomplishments of past students shall be described, since this outcome is an important indicator of the quality of the program. The ability of graduates to become satisfactorily employed and the results of evaluation of individual graduates by independent organizations (for example, through professional certification) provide valuable insight into the effectiveness of a program.*

**Observations:** In recent years, approximately 5 new students per year were enrolled in the Program with a steady state enrollment (MS and PhD) of about 25. The Program Directors indicated that the maximum new enrollment per year (MS and PhD) might be 7-8 students. Graduates from the MS Program rather frequently pursue a PhD in the Program. A reasonable fraction of the graduates ultimately pursue and obtain ABR certification, and the program currently encourages all students to take Part I of the ABR exam in the last semester of the Program or as soon as possible following completion of their degree.

**Requirements:** None

**Recommendations:** None

#### **D. Evaluation of Student Progress and Student-Faculty Interactions**

*The methods for evaluating student progress shall be delineated. The mechanisms of student advising for both academic and research activities shall be described. This may include meetings with the program director, dean, or faculty committees. The governance process to handle the progress of students that are not satisfactory and students' grievances shall be discussed. It is expected that sufficient academic guidance shall be provided to ensure that students graduate in a timely and efficient manner.*

**Observations:** Consistent with CAMPEP requirements. Student progress is monitored any concerns or issues are addressed with the Medical Physics Program Committee.

**Requirements:** None

**Recommendations:** The current leadership structure, i.e., the existence of three co-directors, might be of concern in the student-faculty interactions and evaluation of student progress. For example, if three different students bring forth a specific concern, to whom would they currently address the concern and how would it be assured that each received consistent advice and direction? If the co-director leadership structure is maintained, it is advisable to make sure guidance as to which functions are addressed by which co-director is given in the orientation session and documentation for entering students.

#### **E. New Student Orientation**

*The self-study shall include a description of its orientation process. The incoming student shall clearly understand graduation requirements, student administrative procedures, and any other program expectations. The student shall be aware of program resource faculty, laboratories, safety issues, research opportunities, and funding.*

**Observations:** Consistent with CAMPEP requirements

**Requirements:** None

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### **Confidential**

*Recommendations:* See recommendation under V.D., above.

### **F. Safety and Regulatory Requirements**

*Students may be working in an environment that includes hazards not previously encountered where the potential exists for bodily injury to themselves and others. These may include ionizing radiation, high voltages, magnetic fields, pharmaceuticals, chemicals, biohazards, and automated mechanical motion. The program shall provide introductory safety training regarding the potential dangers that students may encounter and measures to prevent damage to expensive equipment. The program shall have a published set of guidelines and restrictions addressing the relevant safety programs.*

*Observations:* Consistent with CAMPEP requirements

*Requirements:* None

*Recommendations:* None

## **VI. Resources**

## **Substantial Compliance**

### **A. Faculty**

*A list of participating faculty and their role in the program shall be provided. For each faculty member, identify students being supervised, participation in committees and provide a list of courses taught for the previous three years. The faculty shall be categorized by primary areas of specialization in medical physics. A biographical sketch following an appropriate standard format of each participating faculty or staff shall be provided in appendix E. The student-to-teacher ratio shall be presented and projected for the immediate future.*

*Observations:* The program has participating faculty from NSEI, WUSL, MU School of Medicine and University Hospitals and the Harry S. Truman VA Hospital. All faculty members with whom the site visitors met were enthusiastically supportive of the Program. This support was echoed by all administrators with whom we met, including the Provost, Dean of the Graduate School, Dean of the School of Medicine, Dean of Health Professions, and the MU Vice Chancellor for Research. Two additional faculty lines are mentioned in the letter of support from Dean Churchill (Dean of the School of Medicine and past chair of the Department of Radiology). The Dean reinforced the possibility of activation of these two faculty lines if an adequate proposal for such activation is submitted. It was mentioned that the next faculty appointment in support of the Program might be a radiation physics faculty member in support of the new radiation oncology facility currently under construction.

*Requirements:* None

*Recommendations:* The additional faculty lines noted above should be pursued, particularly as the new radiation oncology facility is being commissioned / activated. Continued support of MU Department of Radiology and WUSL radiation physics faculty contributions is critical to continued success of the Program and even more so if any Program growth is anticipated or desired.

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

#### **B. Finances**

*The self-study shall list the methods available to finance graduate assistantships and fellowships and describe the availability of financial aid. Additionally, the self-study shall identify the program's mechanism for assisting students in obtaining funding. The financial burden of a student shall be itemized in the self-study. The level(s) of student funding, breaking out stipend, tuition, and other benefits (e.g., insurance, books, etc), shall be provided.*

**Observations:** The student financial burden per year is adequately described in section VI.C of the self study. The Program successfully funds all PhD students from NSEI and WUSL faculty resources and also supports some funding for the MS students from various sources, including research incentive funds.

**Requirements:** None

**Recommendations:** None

#### **C. Facilities**

*The self-study shall list by category all facilities used by the students. Their location, availability, and specialty shall be indicated. Classrooms shall be easily accessible by the student and have adequate capacity for the class size. They shall meet modern standards of lighting, ventilation, and comfort and be equipped with appropriate instructional visual aids.*

*Student offices shall be available, particularly for master's students for whom a thesis is required and for doctoral students. Office space shall include an individually assigned desk/workspace located reasonably close to research laboratories or classrooms used by the student. Students shall have access to adequate office supplies, copying equipment, and computers.*

*Student laboratories, teaching laboratories and faculty laboratories accessible to the students shall be listed. These laboratories shall be appropriate to the academic and research goals of the program. Laboratories shall have reasonable recent models of instruments and equipment available to students. Clinical equipment available for research shall be described. Machine and electronic shops shall be accessible, and there shall be provisions for maintenance and prompt repair of laboratory equipment and instruments used by the students.*

*Programs shall have adequate clinical facilities. Procedures shall be in place (1) to allow the student reasonable access to clinical equipment, (2) to provide students sufficient training and technical support to ensure safe and proper use of equipment, and (3) to ensure that equipment is left in the proper state for continuing clinical use.*

*The institution shall have a library with holdings appropriate to the size and nature of the medical physics program and the research activities of staff and students. There shall be a minimum of 10 current periodicals, with back runs of no less than 10 years, and a range of other reference materials relevant to medical physics. Web access to appropriate electronic journals shall also be available through the library services.*

**Observations:** Available facilities are described in the self study and were confirmed during the site visit. The primary imaging facilities are located at MU Medical School University Hospital and affiliated clinics in Columbia as well as at the Harry S. Truman Memorial VA Hospital (including extensive small animal imaging facilities). The primary radiation oncology facilities are currently located at WUSL. The MU Research Reactor (10 MWth) is a unique resource that is utilized for student research and laboratories. Limited office space is available for Program students, but is prioritized for PhD students. In discussing this issue with the current students, however, it was not felt to be a substantive limitation. Library, student study space, machine shop, and electronics shop access was confirmed at the time of the site visit and in discussions with the current students.

# C A M P E P

Commission on Accreditation of Medical Physics Education Programs, Inc.

---

## ***Confidential***

*Requirements:* None

*Recommendations:* None

## **VII. Future Plans**

## **Substantial Compliance**

### **A. Summary of Strengths and Needs**

*Observations:* The strengths of the program include a very high level of interdisciplinary research, commitment of the MU faculty as well as senior MU administration, and commitment of the WUSL Department of Radiation Oncology chair and radiation physics faculty, particularly Drs. Klein and Richardson. The research and clinical internship resources available to the students are currently quite adequate and will be further enhanced when the new radiation oncology clinic opens in 2012. Additionally, the site review team members were impressed with quality and enthusiasm of the students currently enrolled in the Program. Finally, it was noted that the co-directors, senior administration, and faculty are keenly aware of the challenges that might be faced by MS graduates in terms of the availability of residency positions beginning in 2014 and plans to address this for the graduates of this Program are being developed.

*Requirements:* None

*Recommendations:* None

### **B. Further Developments and Improvements**

*Observations:* The program identifies appropriate opportunities for development and improvement, including the plan to establish an external advisory board.

*Requirements:* None

*Recommendations:* None

### ***Confidential***

## **VIII. Conclusions**

### **Recommendation of the Site Review Team to the GEPRC**

The program review team recommends full accreditation for a three-year period (with an option for a two-year extension) starting 1 January 2011.

### **Summary of Specific Requirements (taken from all sections above):**

Education in the areas of professional ethics / scientific misconduct / conflict of interest must be provided. Documentation of the means by which this is addressed must be provided in the first annual report from the Program. (See also AAPM Report 159, *Recommended Ethics Curriculum for Medical Physics Graduate and Residency Programs.*)

### **Summary of Specific Recommendations (taken from all sections above):**

1. The *Medical Physics Program Committee* membership should be inclusive of all key groups of faculty actively supporting the Program. (See Section III)
2. The roles of the three co-directors should be very clearly defined to the students in the Program to ensure consistency. (See Section III)
3. The “core curriculum” required of each and every MS degree student should be more clearly defined. (See Section IV.B)
4. The key *Topics of Primary Interest* defined the *Mathematical Methods for Radiological Sciences* section of Report 197 (Section 3.1.6.3), including models for statistical inference, experimental design for hypothesis testing, regression models, multivariate analysis, and categorical data analyses, should be addressed in the curriculum. Coverage of these topics does not necessarily need to be accomplished in a single course, but the Program should be able to provide a concise list of these topics and the course, or courses, in which the topics are addressed. (See Section IV.B)
5. It was clear in the self study and during the site visit that the curriculum is still evolving, with new courses being added and others being modified. For example, one of the two required imaging courses (NE8435) is variably referred to as *Fundamentals of Imaging in Medicine* or *Radiation Oncology Imaging* in the report (and during the site visit). This should be clarified at the time of the first annual report from the Program. (See Section IV.B)
6. The increased involvement and commitment of the WUSL faculty in the curriculum is commendable. As the travel time to or from WUSL is approximately 2 hours, however, distance learning options, e.g., video conferencing, have been implemented for some courses. The students indicated that the current model could be improved substantially. During the site visit, specific plans, funded by MU NSEI, for improved video conferencing were provided. The implementation of these plans should be confirmed in future annual reports from the Program. (See Section IV.B)

# C A M P E P

## Commission on Accreditation of Medical Physics Education Programs, Inc.

---

### ***Confidential***

7. The frequency of offering of a limited number of the required courses is every other year. This may lead to scheduling difficulties and/or large class sizes if the Program enrollment grows beyond the current level. It is recommended that all required courses be offered each year, if possible. (Section IV.C)
3. A formal “top-down” curriculum review should be performed on a regular basis, perhaps every five years. Processes should be established to ensure there is appropriate input and review by all major stakeholders in / contributors to the Program, including the MU/VA faculty, MU School of Medicine faculty, and WSUL faculty. (See Section IV.D)
8. Documentation necessary to ensure compliance with the issues noted in “Observations” of Section V.A, must be maintained and made available for review by CAMPEP if requested. (See Section V.A)
9. The current leadership structure, i.e., the existence of three co-directors, might be of concern in the student-faculty interactions and evaluation of student progress. For example, if three different students bring forth a specific concern, to whom would they currently address the concern and how would it be assured that each received consistent advice and direction? If the co-director leadership structure is maintained, it is advisable to make sure guidance as to which functions are addressed by which co-director is given in the orientation session and documentation for entering students. (See Section V.D)
10. The additional faculty lines in Section VI.A should be pursued, particularly as the new radiation oncology facility is being commissioned / activated. Continued support of MU Department of Radiology and WUSL radiation physics faculty contributions is critical to continued success of the Program and even more so if any Program growth is anticipated or desired. (See Section VI.A)

# C A M P E P

Commission on Accreditation of Medical Physics Education Programs, Inc.

---

## ***Confidential***

	<b>Accreditation Recommendation</b>			
	Full	Limited	Deferred	Withheld
<b>Program Review Team</b>	✓			
<b>Graduate Education Program Review Committee</b>	✓			
<b>CAMPEP Board of Directors</b>				

**Full Accreditation:** Programs that are granted initial accreditation will be accredited for a period of three (3) years. If programs submit acceptable annual reports during the first three (3) years of accreditation, the accreditation will be extended to five (5) years on the recommendation of the GEPRC and approval by the Board. This level of accreditation is awarded to an applicant that is in substantial compliance with CAMPEP standards.

**Accreditation Deferred:** This action may be appropriate for programs that are found be non-compliant to CAMPEP standards for accreditation to allow an adequate period of time for the institution to implement planned or suggested improvements in the program. This action postpones a final decision until specific additional information is provided which brings the program into compliance with CAMPEP standards.

**Accreditation Withheld:** This action is appropriate for programs that are found be not non-compliant to CAMPEP standards for accreditation, nor does it appear that program changes could be achieved within a reasonable period of time to qualify for accreditation. After this decision, should accreditation be pursued, a new application shall be required including the appropriate fee.

# C A M P E P

Commission on Accreditation of Medical Physics Education Programs, Inc.

---

## ***Confidential***

### **Site Visit Itinerary**

April 25

Time	Individual	Location
8:30-9:00	Evan Boote, Acting Program Director	NSEI Conference Room, E 2440 Lafferre Hall
9:00-9:30	Mark A. Prelas, Director of Research and NSEI Program Coordinator	NSEI Conference Room, E 2440 Lafferre Hall
9:30-10:00	Tushar K Ghosh, Director of Graduate Studies, Program Co-Director Sudarshan K. Loyalka, Program Co-Director	NSEI Conference Room, E 2440 Lafferre Hall
9:50-10:10	Open	NSEI Conference Room, E 2440 Lafferre Hall
10:10-10:40	Eric Klein, Wash U Coordinator (Description of Wash U facility)	NSEI Conference Room, E 2440 Lafferre Hall
10:40-11:00	Bob Miller, NSEI, Participant Bob Tompson, NSEI, Participant	NSEI Conference Room, E 2440 Lafferre Hall
11:00-11:30	Lixin Ma, NSEI & Radiology, Participant Tim Hoffman, NSEI & Radiology, Participant Jeff Smith, NSEI & Radiology, Participant	NSEI Conference Room, E 2440 Lafferre Hall
11:30-11:50	Robert Duncan, Vice Chancellor for Research, MU	NSEI Conference Room, E 2440 Lafferre Hall
11:50-12:00	Break	
12:00-12:45	Lunch with Students (16 in attendance)	NSEI Conference Room, E 2440 Lafferre Hall



# C A M P E P

Commission on Accreditation of Medical Physics Education Programs, Inc.

---

## ***Confidential***

1:00-1:45	Bob Churchill Dean, MU Medical School, & Ken Rall, Radiology Chair	Medical School
1:45-2:30	Richard Oliver, Dean School of Health Science, MU Glenn Heggie, Chair, Nuclear Medicine, MU	Medical School
2:30-3:15	Radiology, VA facility tour	Medical School
3:15-4:00	Reactor facility tour (Bill Miller, Cathy Cutler)	Reactor
4:00-5:00	Document Review	

<b>April 26</b>		
8:00-8:30	Brian Foster Provost, MU	Jesse Hall
8:30-9:00	George Justice Dean of Graduate School & Director of NSEI	Jesse Hall
9:00-9:30	Dennis Hallahan Chair of Radiation Oncology, WUSL	NSEI Conference Room, E 2440 Lafferre Hall (teleconference)
9:30-10:15	Tour of NSEI facilities, office space, labs, computer facility	
10:15-11:00	Report Preparation	NSEI Conference Room, E 2440 Lafferre Hall
11:00-11:30	Ghosh, Boote, Prelas, Klein (Exit Discussion)	NSEI Conference Room, E 2440 Lafferre Hall